Carnobacterium maltaromaticum isolated from vacuum-packed beef with long shelf life: morphological and functional characterization

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Introduction

Carnobacterium maltaromaticum is a lactic acid bacterium, and many lactic acid bacteria associated with meat are known for their bactericidal or bacteriostatic activity against other strains, species or genera of bacteria. Some *C. maltaromaticum* strains have been reported to produce class I and II bacteriocins, in addition to circular bacteriocins [1]. Bacteriocin production, however, is not a pre-requisite for the biopreservative efficacy of *Carnobacterium* [2]. In this way, the presence of certain lactic acid bacteria adapted to a low temperature in fresh meat could extend the shelf life and improve the microbial stability and safety of this product.

This study was conducted as part of a research project on meat conservability, in particular vacuum packaged beef displaying very long shelf lives at a temperature close to the freezing point, and its objective was to perform a morphological and functional characterization of *C. maltaromaticum* with potential bioprotective effect isolated from vacuum packaged long shelf life beef.

Materials and Methods

The following parameters of one strain of *C. maltaromaticum* (CFAUS2/DLC/4/E1) isolated from a vacuum packaged *longissimus dorsi*, displaying a shelf-life of 140 days, obtained from a food wholesaler located in the Walloon Region of Belgium, were evaluated: morphological, biochemical and enzymatic profiles, influence of different temperatures (+4 °C, +8 °C or +12 °C) and atmospheres (100 % N_2, 70 %O_2:30 % CO_2 or 30 % O_2:70 % CO_2) on growth, and microbiological stability of beef supplied by a Belgian wholesaler inoculated with *C. maltaromaticum*.

Results

The isolated *C. maltaromaticum* strain presented similar morphological, biochemical and enzymatic profiles as those of two reference strains (LMG 11393 and LMG 22902). Among the studied conditions, a temperature of +12 °C and an atmosphere poor in oxygen (100 % N_2) were the optimal conditions for the growth of *C. maltaromaticum*. Nevertheless, growth on lower temperatures is also possible. After inoculation of beef samples with *C. maltaromaticum* and 7 days of storage under vacuum at −1 °C, no effect was observed on the total viable count and on the count of lactic acid bacteria. A reduction of *Pseudomonas* sp. and *Brochothrix thermosphacta* was observed during the first week of storage under vacuum conditions. After 7 days of subsequent storage of the same samples under modified atmosphere at +4 °C, the inoculant favored the growth of *B. thermosphacta* and inhibited the growth of *Enterobacteriaceae* under 100 % N_2. No effect of the inoculant was observed when an atmosphere rich in oxygen was applied.

Discussion

The evaluation of the influence of different atmospheres showed that the growth of *C. maltaromaticum* was slower in an atmosphere containing O_2 and CO_2. Long-term storage under vacuum at low temperatures are therefore suitable for the growth of this bacterium. An antimicrobial effect against *Enterobacteriaceae* was highlighted on inoculated fresh meat stored under N_2. The functional characterization of this strain will be further pursued by genotypic characterization. Special attention will be taken to study its bioprotective properties.

References

1. Tulini F.L. et al. (2014). Int J Food Microbiol 173: 81-88.
2. Laursen B.G. et al. (2005). Syst Appl Microbiol 28: 151-164.